ARTICLE VII.

Report of a Committee of the American Philosophical Society on Astronomical Observations: containing Observations made in different parts of the United States, on the Solar Eclipse of February 12th, 1831. *Read October* 7, 1831.

THE Committee on Astronomical Observations respectfully present to the Society the observations made by them, in this city, upon the Solar Eclipse of February 12th, 1831; together with such other observations, made in different parts of the United States, as they have been able to collect.

ALEX. DALLAS BACHE.
JOS. ROBERTS, JUN.
ISAIAH LUKENS.

Observations made at Friends' Observatory, in Philadelphia, during the Solar Eclipse of February 12th, 1831. *By Jos. Roberts, Jun. Lat.* 39° 57′ 02″ *N., and long.* 5 *h.* 00 *m.* 37 *sec. West of Greenwich.*

For about one month previous to the eclipse, frequent observations were made in order to determine the effect of the temperature on the position of the transit instrument and the rate of the clock. These two essential instruments having been satisfactorily adjusted by means of the transit of stars selected for that purpose, the day was ushered in with the whole heavens obscured by clouds which continued until about half past ten o'clock, A. M., when the clouds generally disappeared, and the heavens in the vicinity of the sun presented the fine clear sky

blue, which continued generally uninterrupted till near one o'clock, P.M.

At 11 h. 23 m. 17 sec. mean solar time, not corrected for the error of the clock and deviation of the transit instrument, observed a slight derangement in the limb of the sun at the point where the eclipse was expected to begin. This break in the harmony (noticed for the last ten or fifteen minutes) continued to increase until a well defined section of the lunar disc convinced me that this derangement was produced by the interposition of the moon.

At noon, observed the transit of the Sun's eastern limb over the lines of the transit instrument, as follows, viz.

	h.	m.	sec.
No. 1.	0	15	16
No. 2.	0	15	36
Merid.	0	15	56
No. 4.	0	16	16.5
No. 5.	0	16	37
	0	15	56.3

reduced time of transit of sun's eastern limb over the meridian.

The daily rate of the clock from numerous observations, $3''.56$ gaining. The clock fast of mean solar time at the beginning of the eclipse, according to the observed transit and daily rate, $0'\ 15''.414$; to this add for deviation of transit instrument from merid. $0''.104$; gives the state of the clock at the beginning of the eclipse, 0 m. 15.518 sec. fast of mean solar time. So that the true mean solar time of beginning of the eclipse was, 11 h. 23 m. 01.482 sec.

At twelve o'clock, mean time, measured the vertical diameter of the sun with one of Troughton's spider-line micrometers, and found that it required 44.855 revolutions of the screw to bring the lines to zero: and near one o'clock, P.M. made the lines of the micrometer tangents to the sun and moon's disc, in order to measure the maximum of the visible portion of the Sun's diameter at the time of the greatest obscuration. These lines I caused to approach each other, until the eclipse ceased to increase; and I *afterwards* found that 1.94 turns of the screw brought them together. It may be proper to remark in

relation to the last observation, that the dread of being involved in a total eclipse by a large collection of clouds near at hand and rapidly approaching, and which completely obscured the sun before I had time to relieve the eye and finish the observation by bringing the lines to zero, has left a doubt as to its exactness. I, however, give it, and *future* observations may determine its value; for after careful inquiry I do not find any corresponding observation in relation to this matter.

At 2 h. 25 m. 24 sec. mean solar time, corrected for the error of the clock, the clouds too dense to see the sun through the coloured glass of the large telescope; but from an observation made with a telescope without a coloured glass, the eclipse had not ended. At 2 h. 25 m. 59 sec. corrected for the error of the clock, still thin clouds before the sun, but have the impression that the eclipse had ceased. At 2 h. 27 m. the sky in the vicinity of the sun very clear, and the eclipse ended beyond any doubt. The preceding observations were made with a 46 inch achromatic telescope by Tully, Islington, London, with a $3\frac{1}{4}$ inches object glass, and a transit instrument by Dollond, London, 30 inches by $2\frac{1}{4}$. The power used 38. The eye protected by a glass of a red colour.

During the eclipse the thermometer and barometer stood as follows, viz.

Time of making observation.	Sixe's Ther. in Observatory.	Mercurial Ther. in Sun.	Spirit of Wine Ther. in Sun.	Troughton's Barometer.	Remarks.
h. m.				ins.	
10 30	29°			30.161	Very clear.
10 45	29	54°	52°	30.161	Do.
11 00	31	56	53	30.164	Do.
11 40	32	"	"	"	Do.
1 00	31	32.5	32	30.150	Flying clouds.
1 10	30.5	"	"	30.141	Dense clouds.
1 25	30	32.5	32	30.141	Do.
2 00	30.5	35	34	30.141	Do.
2 05	31	35	34	"	Flying clouds.
2 45	32	41	38	30.153	Very clear.

Observations of the Beginning and End of the Eclipse of the Sun, February 12, 1831, *by Sears C. Walker, in lat.* 39° 57′ *N. and long.* 1433 *feet west of Friends' Observatory, Philadelphia.*

	h.	m.	sec.	
Beginning,	11	23	10 A.M.	Mean solar time at
End,	2	25	49 P.M.	Observatory.

Telescope $3\frac{1}{2}$ feet achromatic, by Jones, London: power 40 to 50.

Observations made at the time of the Eclipse of the Sun, 2d Month, (February) 12th, 1831, *at Burlington, N. J., lat.* 40° 5′ 20″ *N., long. not yet determined. By John Gummere.*

For the time, I made use of a very good chronometer by Lukens, accurately rated by Jos. Roberts, Jun. and examined the third day after the eclipse. From the regularity of its movement, its state, in Philadelphia time, at the time of the eclipse may be regarded as known within one or at most two seconds. I observed with one of Dollond's 42 inch achromatics, with a power 80. My brother S. R. Gummere observed with my 3 feet Gregorian reflector, with power of 120. At the beginning of the eclipse the sky was very clear, at least in the vicinity of the sun, thus giving the opportunity for an accurate observation. Our impressions of the instant of commencement did not differ half a second. Frequently during the latter part of the eclipse, and at the termination, there were obstructing clouds, so that the time of end could only be determined within limits. The time of beginning accurately determined, was 11 h. 24 m. 2 sec. A.M. mean time Philadelphia. At 2 h. 24 m. 42 sec. P.M. the eclipse had not terminated. At 2 h. 26 m. 21 sec. it was entirely ended.

At the time of greatest obscuration, the cusps were very sharp and well defined; but a thread of light extended from each, to a considerable distance along the circumference of the sun's disc. About a minute after, a spot of light was observed a few degrees from the south western cusp, extending inwards from the thread proceeding from that cusp. Its appearance is represented in the accompanying figure.

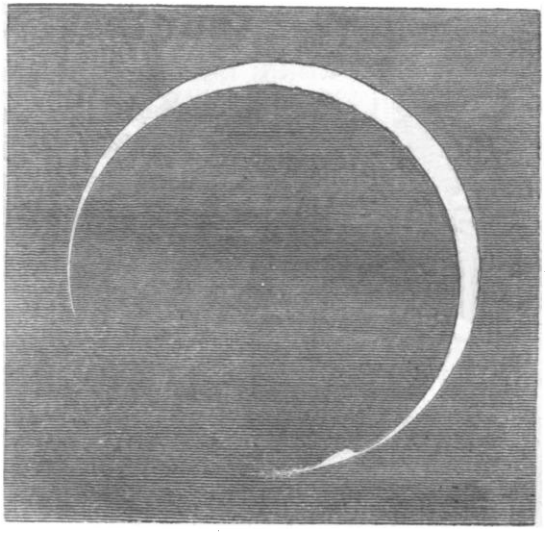
At the commencement of the eclipse the barometer stood at 30.24 inches. At 1 o'clock it stood at 30.16 inches and continued so until end of eclipse.

I had one thermometer suspended in the shade, and three exposed to the sun's rays. The first of these three has a metallic scale, covered in front with a glass; the second has a metallic scale not covered; and the third has an ivory scale. Their states at four different times, as below.

	Shade.	Sun.		
		1st.	2d.	3d.
11 h. 24 m. A.M.	26°	81°	62°	52°
1 h. 0 m. P.M.	24	37	30	29
1 h. 10 m. P.M.	25	31	28	27
1 h. 26 m. P.M.	31	46	37	34

The solar spectrum was observed several times during the eclipse. We were not sensible of much change in it, but thought that about the time of greatest obscuration, the violet, though very bright, was rather paler than at other times.

A 30 inch magnetic needle, made by Lukens, was observed at 11, 1, $2\frac{1}{2}$, and 5 o'clock. From 11 to 1, the north end moved 6′ to the west. From 1 to $2\frac{1}{2}$, it moved 3′ to the west; and from $2\frac{1}{2}$ to 5, it moved 6′ to the east.



Observations of the Solar Eclipse of 12th February 1831, by Professor James Renwick. Made at Columbia College, New York. Lat. 40° 42′ 43″ N. Long., determined by the Solar Eclipse of August 27th, 1823 combined with the mean of 80 Lunar distances, 4 h. 56′ 13.45″ west from Greenwich.

BEGINNING. Contact of sun and moon's limbs, observed by a refracting telescope of Dollond of 5 feet focus, using the second astronomic power. The time being noted by a chronometer of Parkinson and Frodshum, No. 1102, rated by Mr Demilt, 23h. 30′ 29″.2

Watch slow of mean time, 21″

Mean time of beginning, 23 h. 30′ 50″.2

The end was not observed in consequence of the sun being hidden by clouds.

Observations of the Eclipse of the Sun, February 12, 1831, by Robert Treat Paine, at Cape Malabar Light-house, in Lat. 41° 32′ 58″.3 N.; Long. by Chronometer 70° 01′ 20″ west.

	h.	m.	sec.		
Beginning of the Eclipse,	11	55	56.0	A.M.	Mean solar time.
Formation of the Ring,	1	26	54.6	P.M.	
Rupture of the Ring,	1	28	23.8	P.M.	
End of the Eclipse,	2	53	8.2	P.M.	

The sky very clear all day; observations very fine and satisfactory. Telescope 4½ feet Dollond, with the smallest astronomical eye piece; power about 60. The thermometer hanging on a S. E. wall in the sun fell from 83° to 29°.

Results of the Observation of the Solar Eclipse of 12*th February* 1831, *made under the Colonnade of the south front of the President's house at the City of Washington, lat.* 38° 53′ 12″; *long.* 76° 57′ (*approximate*), *by F. R. Hassler.*

A properly rated chronometer was used for the determination of time, and one of the repeating theodolites from the collection for the survey of the coast, with a one foot vertical circle, for the observations of time, &c. The reduction of the time of the chronometer indicated by the observations being made, gave,

	Apparent time.			Mean time.		
	h.	m.	sec.	h.	m.	sec.
For the Beginning,	10	55	56	11	10	30
End,	2	00	54.5	2	15	28.5

Duration, 3 h. 4 m. 58.5 sec.

Stand of the barometer observed about 9 o'clock, A.M. 30.62 ins. Beginning of the Eclipse, 30.56 ins. and hardly varied for 0.01 in. the rest of the day.

The thermometer stood as follows:

At 8 o'clock, A.M.	29.5° Fahr.
Beginning of Eclipse,	32.0
Greatest obscuration,	28.0
End of the Eclipse,	37.0
At 4 o'clock, P.M.	38.0
Sunset,	32.0

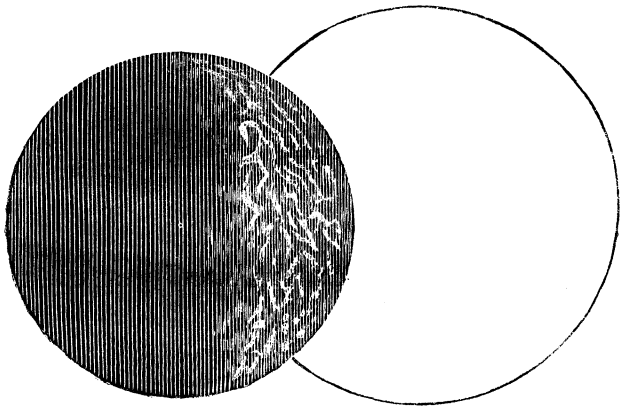
The sky was perfectly clear, the weather generally cold, with a harsh wind. During the greatest obscuration the feelings of an intense cold, and a kind of disagreeable gloom, were remarked by every person present, which subsided only when a considerable part of the sun was again clear.

The most remarkable phenomenon was the distinctly painted inequalities of the moon, by the reflection of light and shade upon its disk, presenting, apparently, elevations brilliantly illuminated, and intervals shaded in an ash coloured shade, more or less dark and distinct, as they were nearer to or farther from the sun, the edge of the moon towards the sun being always fully dark.

This appearance, beginning when about one-eighth of the diameter of the moon was immersed, extended itself, with various alterations in the

appearance, to about one-third of the moon's diameter, when it gradually faded into indistinctness, and the whole surface of the moon appeared equally dark. The same took place again in the inverse order, with varied configurations, towards the end of the eclipse.

The telescope with which I observed being very steady, that on the repeating theodolite, with a magnifying power of about 70 times, the phenomenon could be distinctly observed and followed; the annexed imperfect figure may convey an idea of it.



Observations on the Eclipse of the Sun, February 12, 1831, *by Professor R. M. Patterson, M.D., at the University of Virginia, in lat.* 38° 2′ 3″ *N., and long.* 5 *h.* 14 *m.* 4.8 *sec. W. of Greenwich.*

	h.	m.	sec.	
Beginning of Eclipse,	11	0	26	Mean solar time.
End,	2	7	20	

Meteorological Observations during the Solar Eclipse of February 12*th*, 1831, *by A. D. Bache, Professor of Natural Philosophy and Chemistry in the University of Pennsylvania.*

The principal objects in view in the following observations were, first: to measure the diminution of light produced by the eclipse; that of direct light, as well as of the light diffused by reflection in the atmosphere and from bodies at or near the earth's surface.

Second, to measure the variations in the temperature of the air during the eclipse.

The instrument adapted to the measurements first enumerated is the photometer of Leslie: this consists of a differential thermometer having one bulb blackened. The blackened bulb absorbs the heat accompanying the solar light, while the transparent bulb either transmits or reflects it; the temperature of the dark bulb is raised, the air within it is expanded, and the liquid forced up the stem attached to the opposite bulb: the amount of the rise of the liquid is measured by a scale attached to this stem. The effect of variations in the temperature of the air about this instrument is in a great measure avoided by its differential form. The graduation of the scale of the photometer is arbitrary, and the measures which it gives entirely relative. It will be convenient to place the zero at the point at which the liquid in the stem stands in a dark room.

The photometer used in the observations upon the direct light of the sun had one bulb covered with black silk. The observations have been reduced to the point of the scale, which corresponds to a dark room as a zero. A glass case protected the instrument from currents of air. The position remained invariable during the course of the observations, viz. at the south window of the observatory attached to the Friends' school in Fourth-street.

A second photometer was placed within the observatory and exposed to the diffused light, which entered through three windows extending nearly from the floor to the ceiling and facing the S.E., South, and S.W. One bulb of this instrument was of blue glass. The observations have, as in the case of the other photometer, been reduced to the point at which the liquid stands in a dark room as a zero: the degrees do not correspond with those of the first instrument. A glass case covered this photometer.

The second object was attained by the use of a metallic thermometer of Breguet's make, for the opportunity of using which I am indebted to C. N. Bancker, Esq. This instrument was placed in the shade within the south window of the open observatory. There had been no fire during the winter in the observatory, nor, but on a few occasions, in the building with which it is connected. A comparison of

the scale, attached to this metallic thermometer, with that of a mercurial thermometer carefully verified, was made subsequent to the day of observation, and extended through a considerable range of temperature, obtained by atmospheric variations; there resulted a correction in part of the scale, which has been applied in converting the degrees of Breguet's scale into those of Fahrenheit.

The compound effect produced by the heat from the direct and reflected rays of the sun and by the temperature of the atmosphere was noted, as affording a check upon the observations made with the photometer in the sun and thermometer in the shade. To measure this a thermometer having the bulb blackened was exposed to the direct rays of the sun by placing it in the south window of the observatory. The thermometer was one made by Bate, the scale was metallic, and the instrument uninclosed by a case: the freezing point had been verified to guard against the effect of a variation in the scale, which has been found in many cases to take place after the graduation of the instrument.

In addition to the principal observations, others were made from time to time with the hygrometer and barometer. The hygrometer was a dew-point instrument of the kind described by Jones in the Transactions of the Royal Society of London for 1826: it consisted of a mercurial thermometer with a small bulb of blue glass; one of the hemispheres into which this bulb would have been divided by a vertical plane, was covered with a piece of stuff held in its place by a metallic ring which served further to prevent the ether used in cooling the bulb from flowing over the uncoated part.

The height of the mercury in a common barometer belonging to the observatory was recorded.

On the morning of the twelfth, from about nine o'clock until some minutes before the coming on of the eclipse, the sun was obscured by dense clouds. At this latter period the clouds had been dispersed and a tolerably favourable state of weather succeeded, the observations being interfered with but occasionally by passing clouds. About ten minutes after the time of greatest obscuration clouds again came up, and varying only in density, continued with but one short interval, until night.

Observations were made upon the photometer in the sun, and upon the thermometers at intervals, generally, of five minutes during the

time of the eclipse. During the most interesting period, the half hour between half past twelve and one, containing the time of greatest obscuration, the photometer in the sun was observed every minute. The record of the observations is extended throughout the period of the eclipse notwithstanding the unfavourable state of the weather, that the influence of the eclipse upon the instruments may be distinctly seen, independently of the loss of light from the interference of clouds. The instruments had been placed in appropriate situations at the University two days preceding that on which they were to be used, and their indications recorded hourly that the faults of observation might be reduced to a small limit. They were likewise observed hourly two days subsequent to the twelfth, that if any derangement had occurred, it might not escape detection.

A table is subjoined containing a record of the observations upon the photometers and thermometers, beginning with that at 11 A.M. on the 12th of February, and terminating with the observation at 2 h. 35′ P.M. The first two columns contain the times of observation, given by the astronomical clock of the observatory; the third the heights of the photometer exposed to diffused light; the fourth those of the photometer exposed to the direct rays of the sun; in the fifth are recorded the states of the atmosphere at the times of observation; in the sixth the temperature as shown by a thermometer in the shade; in the seventh the checks afforded upon the observations in columns four and six by the heights of the thermometer with the blackened bulb exposed to the direct rays of the sun.

The results of observations upon the dew-point and upon the barometer are placed in the remarks upon the table by which it is followed.

Time.		Photometer in shade.	Photometer in Sun.	Remarks on Weather.	Breguet's Thermometer.	Ther. with blackened bulb.	Remarks.
Hours.	*Mins.*	*Degs.*	*Degs.*		*Degs. of Fahr.*	*Degs. of Fahr.*	
				Cloudy.			
11		9	62	Clouds less dense. -	36	48½	
11	10	9	51½	Clouds more dense. -	33¼	58½	
11	23			Clear. - - -			*Eclipse begins.*
11	30	9	61½	Fleecy clouds. - -	35½	66½	
11	36	9	57	Almost clear. - -	36		
11	40	8½	56	Clear, with occasional	35¼	63	
11	50		50	fleeces over ⊙. -	35	63	
11	55	8	47	Slight haze. - -	34¾	62	
12	05	8	41	Clear. - - -	34½	58	
12	10	7½	37	" - - -	34	54½	
12	20	7	31	" - - -	33¾	49½	
12	25	5	29	A cloud begins. -	33¾	49	
12	30	4½	22	Cloud over ⊙. -	33¼	45½	
12	35		18½	Cloud passing off. -	32¾	41½	
12	40		15	Clear. - - -	32½		
12	41		15¼	" - - -			
12	42		14½	" - - -	32¼		
12	43		14	" - - -			
12	44		14	" - - -	32½		
12	45		13	" - - -	32	38	
12	46		12	" - - -			
12	47		12	" - - -			
12	48		8	Cloud passing. - -	32½	36	
12	49		9½	Cloud off. - -			
12	50		10	Clear. - - -	32	35½	
12	51		8	Cloud. - - -			
12	52		7	Edge of cloud over ⊙.	31¾		
12	53		6½	" " - -		34	
12	54		7	Clear. - - -		34	
12	55		6½	" - - -	31½	33½	
12	56		5	" - - -			
12	57		4½	" - - -	31½	32½	
12	58		4	" - - -			Time of greatest obscuration by observations.
12	59		4	" - - -	30¾	31½	
1	00		4½	" - - -			
1	05	3	4½	" - - -	30¾	30½	
1	10		5½	Clouds. - - -	30¾	30½	
1	15	4	6	Less dense. - -	30¾	31	
1	20	4	6½	Dense cloud. - -	30¾	31½	
1	25	6	12	Cloud. - - -	30¾	33	
1	30	5	8	Dense cloud. - -	30¾	32	
1	35	5	9	Clouds. - - -	30¾	32	
1	40	5½	10	" - - -	31	31½	
1	45	6	11	" - - -	31½	35	
1	50	6	11½	" - - -	31½	35	
1	55	6½	15	Clouds less dense. -	32	36	
2	00	5½	11	Dense clouds. - -	32	37	
2	05		13½	Less dense. - -	32½		
2	10	5½	11	Very dense black clouds.			
2	15		10	" " - -			
2	20		10	" " - -	32	36	
2	23	6½	13	Clouds passing off. -			
2	26		14	Less dense. - -			*Eclipse ends.*
2	29		42	Clear. - - -			
2	30		51	" - - -	35		
2	35	7	27	Clouding over. -	35¾	56	

It appears from the table just given, that the liquid in the stem of the uncoated bulb of the photometer in the sun began to descend, from the time of the first observation after the beginning of the eclipse; a descent only occasionally interrupted by the effect of flying clouds; that the minimum was reached at 12 h. 58′ a 59′, when a rise of the liquid commenced, which was progressive notwithstanding the coming up of clouds. At one o'clock with a clear sky, the instrument stood at $4\frac{1}{2}$ degrees, while at ten minutes after one with a white cloud interposed, but with the eclipse less on, it stood at $5\frac{1}{2}$ degrees: at twenty minutes past one, with a dense cloud covering the sun, the photometer had risen to $6\frac{1}{2}$ degrees, and at fifteen minutes past two, dense black clouds intervening, stood at 10 degrees.

The time of greatest obscuration given by the photometer affords a fair test of its sensibility. Correcting the calculated time as given in the American Almanac for the difference between the time of beginning as observed by Mr Roberts and the calculated time there given, the time of greatest obscuration to the nearest minute was 12 h. 57′. The observed minima of the photometer being at 12 h. 58′ and 12 h. 59′, the true minimum is fairly inferred to be at 12 h. $58\frac{1}{2}'$, or within one minute and a half of the calculated time of greatest obscuration.

Observations made at 1 P.M. of the 13th and 14th of February, gave 56.5 degrees of this photometer for the amount of light at that hour; at the time of greatest obscuration on the 12th (within a few minutes of one o'clock), the photometer stood at 4 degrees. We may calculate from these data the proportion of the solar disc which remained unobscured at the time referred to, on the 12th. For as 56.5, the measure of the light from the unobscured disc : 4, the measure at the same time on the 12th, viz. at the time of greatest obscuration : : 1 : proportion of the disc remaining unobscured, which is, therefore, $\frac{1}{14.1}$, or about $\frac{1}{14}$th of the whole disc. The calculation of this luminous area from the data afforded by the tables, viz. the semi-diameters of the sun and moon, together with the number of digits eclipsed, as given by the observations of Mr Roberts (11.481 digits), gives 20,500″ for this area, or $\frac{1}{14.5}$ of the whole disc. The near agree-

ment of these results seems to confirm the observations* that the degree of light near the edges of the sun's disc is as great as that at the centre, contrary to what was supposed by Bouguer when he drew from his observations the inference of the existence of a solar atmosphere.

The diffused light, as shown by the heights of the photometer in the shade, followed in its decrease the diminution of the direct light, as observed by the instrument in the sun; when observations with the latter instrument were made at short intervals it was necessary to neglect the former. The object in view in the use of this instrument was to determine the measure of the diffused light in terms of the light of a clear day at some period before sun-set; the situation was found to render accuracy in this result impossible.

The thermometer in the shade began to fall within at least thirteen minutes after the commencement of the eclipse, the interruption from fleecy clouds preventing the precise time from being ascertained. The fall was steady until 12 h. 59′, when the minimum was reached; the temperature had not risen at 1 h. 5′, owing to the coming up of clouds, this circumstance preventing the diminution of the eclipse from being felt. At half past eleven A.M. this thermometer stood at $35\frac{1}{2}°$ F.: the minimum was $30\frac{3}{4}°$ F., giving, if we disregard the effect of passing clouds, an absolute decrease of temperature due to the eclipse, of $4\frac{3}{4}°$ F. To this we must add for the total effect the preventing an increase of heat as the sun approached the meridian. To the effects of this change those persons who were in the open air in the shade were exposed.

The test of the measurements of the photometer in the sun and thermometer in the shade, afforded by the thermometer with the blackened bulb, gives evidence of the satisfactory performance of both those instruments. This thermometer stood at $66\frac{1}{2}°$ F. at 11 h. 30′, when a fall commenced which was parallel with that of the photometer until the temperature of the air was nearly reached, when the effect of the coldness of the air, aided by the influence of clouds, caused a further descent, while the photometer had begun to rise; with this instrument it soon resumed a parallel course at a lower temperature

* Francœur, Uranographie, pp. 71 and 72.

than corresponded to the degrees of the photometer, in descending. The difference of the minima of the two thermometers is but one-fourth of a degree, a quantity less than the error of observation to which such instruments are liable. The fall of the thermometer in the sun was from $66\frac{1}{2}^\circ$ to $31\frac{1}{2}^\circ$ from the effect of the eclipse; the total fall during the eclipse from $66\frac{1}{2}^\circ$ to $30\frac{1}{2}^\circ$, or 36 degrees. To the effects of such a change those who were exposed to the direct rays of the sun, from half past eleven until one o'clock, were subjected. The sensation of cold felt during the middle of the eclipse is thus easily accounted for, a sensation which would have warranted the belief of the exposure to a temperature much lower than $30\frac{1}{2}^\circ$ F. If any confirmation could be required in relation to the accuracy of the thermometer in opposition to the fallable test of the sensation of cold, it was to be had in the fact that the water which had thawed in the sun before the commencement of the eclipse did not recongeal until towards night-fall.

The barometer varied but slightly during the day: at noon it stood at 30.115, at one o'clock at 30.105, and at five P.M. at 30.105.

The dew-point varied about $3\frac{1}{2}^\circ$ F. during the day; it fell to one of its minimum points, 8° F., during the eclipse.

I subjoin the results of the observations made for me at the University, by an intelligent assistant, upon the power of the lens to produce combustion. The burning powers of two double convex lenses were tried at intervals: the smaller lens has a diameter of six inches and focal length six and three-fourths inches; the larger is eighteen inches in diameter with a focal length of twenty-five inches: for the use of this latter I am indebted to Dr Hare.

The smaller lens ceased to set fire to agaric at 12 h. 49′, or about eight minutes before the time of greatest obscuration. The larger lens lost its power of burning white paper at 12 h. 36′, and of setting fire to agaric at 12 h. 53′, about four minutes before the time of greatest obscuration. The state of the atmosphere prevented the confirmation or correction of these results by observations after the time of greatest obscuration.